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Title : CHANNEL MODELING BASED ON 3-D WAVE SCATTERING COHERENT DD EW-RLS AND DD NLMS ESTIMATION OF OFDM-MIMO IN WIRELESS COMMUNICATION

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In this work, a geometrically-based of three-dimensional (3-D) wave scattering MIMO channel model is developed to accomplish practical mobile communication systems with MIMO and OFDM technologies, which is concerned with MIMO channel modeling and effect of realistic channels on the theoretical capacity. For this aim, the correlation of joint spatial-temporal and temporal functions are derived and analytically evaluated. Numerical results show that the elevation angle has considerable effect on the spatial correlation, thereby on the MIMO system capacity, in case of vertical orientation of the antenna array of the mobile station (MS). Thus, 3-D scattering MIMO channel modeling is necessary for accurately predicting the MIMO systems performance. Particularly the focus has been made on the estimation performance of the exponentially weighted recursive least square (EW-RLS) and low complexity least mean square (NLMS) estimators. These estimators are then extended to work in the decision-directed (DD) mode to track the time variations of the channel in Low mobility (indoor) as well as moderate mobility (outdoor) environments. For performance comparison, channel estimation based on least-squared (LS) method has been used as the baseline study. All the purpose estimators use either preamble sequences or pilot symbols to carry out the estimation process. Simulation results have demonstrated that time-domain adaptive channel estimation and tracking in MIMO OFDM systems based on the DD EW-RLS and DD-NLMS is very effective in slowly to moderate time-varying fading channels. The proposed estimator has good estimation and tracking capabilities especially for slow fading channel ($f_d T_s$=0.00544) It has also shown that time-domain channel estimation in MIMO OFDM system is in more accurate and fewer complexes compared to its counterpart in frequency-domain. Furthermore, it was observed that the performance of the DD EW-RLS estimator always outperform the DD-NLMS estimator in slowly time-varying channels (indoor environments). However, it was found that the tracking performance of the DD-NLMS estimator is better than that of the DD EW-RLS at higher mobility (outdoor environments) and higher SNR environment. As the training rate reduces, the performance of the DD EW-RLS estimator outperforms that of the DD-NLMS at low SNR; however, similar performance of both estimators is obtained at high SNR. The results are shown for Doppler frequencies of f_d=40Hz (i.e. Doppler rate of variations, $f_d T_s$=0.00544) and f_d=75Hz (representing Doppler rate $f_d T_s$=0.0102), which are corresponding to mobile speeds of roughly 18 Km/h (indoor scenario) and 34 Km/h (outdoor scenario), respectively, assuming radio frequency of 2.4 GHz.